# PATENT ABSTRACTS OF JAPAN

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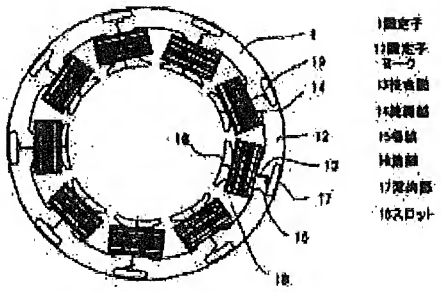
(71)Applicant : MATSUSHITA ELECTRIC IND CO LTD
(72)Inventor : FUNAMI JUN

## (54) ENCLOSED ELECTRIC COMPRESSOR

(57)Abstract:
PROBLEM TO BE SOLVED: To realize less noise equivalent to that of an integral type by improving the rigidity of the structurally divided stator of a brushless motor for an enclosed electric compressor and restraining vibration.
SOLUTION: The stator 1 is radially divided with regard to the center of a tooth 16 in the circumferential direction, its extending outer periphery is formed into a thin wall 17, the prescribed number of jointed thin walls are bent into a circular shape to receive external tightening force by the whole tooth for prevention of deformation, thus improving apparent rigidity by internal stress.



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## CLAIMS

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[Claim(s)]
[Claim 1]
A stator core which consists of two or more tooth parts which stored a compressor style and a brushless motor which drives this in a well-closed container, and in which a stator of said brushless motor was installed toward a center from inner circumference of an approximately annular stator yoke and said stator yoke.
Winding looped around said tooth part via an electric insulator.
Are the encapsulated type electrically-driven compressor provided with the above, and it comes to divide each into a diameter direction as for said two or more tooth parts, and except for at least one tooth part, it is made and, as for said division, said thin-walled part comes to connect adjacent tooth part of each other so that a thin-walled part may remain on a periphery of a stator yoke.

[Claim 2]
An encapsulated type electrically-driven compressor characterized by being the encapsulated type electrically-driven compressor according to claim 1, and a stator core's laminating a griddle, forming it, and said a part of griddle's having a thin-walled part of a stator yoke, and coming to separate a portion applicable to a thin-walled part otherwise.
[Claim 3]
An encapsulated type electrically-driven compressor which is the encapsulated type electrically-driven compressor according to claim 1 to 2, and is characterized by providing space between a stator yoke thin-walled part and a tooth part division plane of composition.
[Claim 4]
A closed compressor which is the encapsulated type electrically-driven compressor according to claim 3, and is characterized by coming to arrange space provided between a stator yoke thin-walled part and a tooth part division plane of composition in a hoop direction center position of a tooth part.
[Claim 5]
A closed compressor which is the encapsulated type electrically-driven compressor according to claim 3, provides a guide part which served as tabling in space provided between a stator yoke thin-walled part and a tooth part division plane of composition, and is characterized by things.
[Claim 6]
An encapsulated type electrically-driven compressor which is the encapsulated type electrically-driven compressor according to claim 3 to 4, and is characterized by using space provided between a stator yoke thin-walled part and a tooth part division plane of composition as a refrigerant passage.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]
[0001]
[Field of the Invention]
This invention relates to the encapsulated type electrically-driven compressor used for an air conditioner, a freezer machine, etc.
[0002]
[Description of the Prior Art]
As for the stator of the concentrated-winding brushless motor used for the conventional encapsulated type electrically-driven compressor, it is in use that a stator yoke like drawing 7 consists of an integral-type lamination griddle. In recent years, the stator (an assembled die is called henceforth) of the assembled die constituted by the yoke which combines the stator pieces which consist of a lamination griddle divided at the center of the yoke which connects the tooth part and tooth part of a stator like drawing 8 winding improve efficiency and for the purpose of reduction of molding die cost is beginning to be used. . [ whether as shown in drawing 9 (a) as a constitution method of an assembled-die stator, after constituting each divided stator pieces independently, it combines and fixes by welding etc., and ] . [ whether the hook for tabling is provided in the plane of composition of the stator pieces divided like drawing 9 (b), and it forms in linear shape at an after-connection circle configuration, and ] One place of the plane of composition of the stator pieces divided like drawing 9 (c) is beforehand connected with thin meat, it forms in linear shape, and, in the back, the method of bending and fixing to a circle configuration, etc. are taken (for example, refer to patent documents 1).
[0003]
Winding with which wind 22 around the yoke of the stator 21, 14 was wound around the insulating paper, and 15 was wound around the tooth part 16 of the stator yoke in drawing 7. In drawing 8, 23 is a stator, and puts together and comprises the plane of composition Xa of the divided stator pieces 24, and Xb. 24 is a tooth part of a stator. The conventional example of shape in the plane of composition X of the stator yoke 23 is shown in drawing 9 (a), (b), and (c).
[0004]
In drawing 9 (a), 26a and 26b are fixed by the engage part of 29a and 29b in a plane of composition, and fix the plane-of-composition peripheries of each by welding etc. In drawing 9 (b), 27a and 27b carry out a connecting lock by the hooking portion of 30a and 30b in a plane of composition, and fix the last combination side by welding etc. In drawing 9 (c), the dividing part is beforehand connected with linear shape by the thin-walled part, bends this thin-walled part circularly, joins the planes of composition 28a and 28b, and is fixed by welding etc. in the last plane of composition.
[0005]
The big difference in whether winding is inserted in the state of [ circular ] whether after winding winding around a core, mold on circular, and it is made a stator is among the composition shown in drawing 7 and drawing 8.
[0006]
[Patent documents 1]
JP,H9-191588,A
[0007]
[Problem(s) to be Solved by the Invention]

In the electric motor stator of the encapsulated type electrically-driven compressor shown in drawing 7, the yield of the material in a winding man hour and formation of a yoke was low, and the cost of the metallic mold to pierce also had large SUBJECT to say.

[0008]

It had the following SUBJECT, although winding efficiency increased also in the electric motor stator of which closed compressor shown in drawing 8 aiming at the solution.

[0009]

Since rigidity becomes low since the 1st has a plane of composition in the yoke part which connects the tooth part and tooth part of a stator also in which composition, and it becomes easy to vibrate, noise should become large. By tightness BAME immobilization in the drum shell of the pressure vessel which is the method to the compressor of a general stator to incorporate, the stator inner circumference side should transform the 2nd and they should affect performance. The 3rd is that the leakage loss of magnetic flux increases in each plane of composition. In the case of the closed compressor shown in drawing 9 (a), since the tooth parts of each were constituted independently in addition to said SUBJECT, it also had SUBJECT to which an assembly becomes complicated.

[0010]

Though it is the same winding insertion type as the electric motor stator of the closed compressor shown in drawing 7 in view of this conventional SUBJECT, this invention, By dividing a stator yoke tooth part radially at the center of a hoop direction, connecting each stator pieces with thin meat in a periphery, developing linearly, bending circularly after formation, and making with a stator, Realize and the cost of the metallic mold to pierce also lowers the die-cutting yield of the assembled-die average of conventional example drawing 8, Distortion is suppressed by making the power committed by tightness BAME to the drum shell of the pressure vessel which is the method to the compressor of a general stator to incorporate received in the plane of composition where the tooth part of this stator is large, And vibration by a torque variation is suppressed by the rigid rise of the appearance by the internal stress generated in the plane of composition of this tooth part, and it aims at providing the encapsulated type electrically-driven compressor of about the same low noise as an integral type, being with an assembled die.

[0011]

[Embodiment of the Invention]

The encapsulated type electrically-driven compressor according to claim 1 stores a compressor style and the brushless motor which drives this in a well-closed container, and the stator of said brushless motor, The stator core which consists of two or more tooth parts installed toward the center from the inner circumference of an approximately annular stator yoke and said stator yoke, It is an encapsulated type electrically-driven compressor which consists of winding looped around said tooth part via the electric insulator, Come to divide each into a diameter direction and said two or more tooth parts remove at least one tooth part, By being made and an adjacent tooth part's coming to connect said division by said thin-walled part mutually so that a thin-walled part may remain on the periphery of a stator yoke, and piercing in the form which developed the stator core so that a yoke part might become an abbreviated straight line, The stator core griddle for two sheets is arranged so that a mutual tooth part may be engaged, and it has the operation that it has come out from the griddle sheet of material to pierce a stator core griddle efficiently. It becomes difficult to produce distortion by making the power by tightness BAME to the drum shell of the pressure vessel which is the method to the compressor of a general stator to incorporate received in the plane of composition where the tooth part of this stator is large. It has the operation that apparent tooth part rigidity rises with the internal stress generated in the whole tooth flank.

[0012]

The encapsulated type electrically-driven compressor according to claim 2 is the encapsulated type electrically-driven compressor according to claim 1, A stator core laminates a griddle, and is formed and, as for said griddle, a part has a thin-walled part of a stator yoke, Since what is necessary is just to make others transform the thin-walled part formed in some griddles when it comes to separate the portion applicable to a thin-walled part and a yoke part bends the stator core pierced and laminated by approximately linear shape to cylindrical shape, it has the operation of becoming possible to bend by smaller power.

[0013]

The encapsulated type electrically-driven compressor according to claim 3 is the encapsulated type electrically-driven compressor according to claim 1 to 2, Since it has come out to miss the thin-walled part extruded by changing toward the inside by having provided space when space was provided between the stator yoke thin-walled part and the tooth part division plane of composition, and a thin-walled part is bent and changes, it has the operation that bending work becomes possible more smoothly.

[0014]

The encapsulated type electrically-driven compressor according to claim 4 is the encapsulated type electrically-driven compressor according to claim 3, Since it comes to arrange the space provided between the stator yoke thin-walled part and the tooth part division plane of composition in the hoop direction center position of a tooth part and space is arranged in the smallest place of magnetic flux density, it has the operation that there is almost no degradation of the characteristic.

[0015]

The closed compressor according to claim 5 is the encapsulated type electrically-driven compressor according to claim 3, comes to provide the guide part which served as tabling in the space provided between the stator yoke thin-walled part and the tooth part division plane of composition, and has the operation that engagement power of the clenched tooth parts can be strengthened.

[0016]

The closed compressor according to claim 6 is the encapsulated type electrically-driven compressor according to claim 3 to 4, It has the operation that it has come out to acquire a bigger chilling effect by passing a refrigerant with the work which cools an electric motor near the big winding of a rise in heat, using the space provided between the stator yoke thin-walled part and the tooth part division plane of composition as a refrigerant passage.

[0017]

(Embodiment 1)

An embodiment of the invention is described with reference to Drawings below.

[0018]

Drawing 1 is a figure showing the stator of the brushless motor in the encapsulated type electrically-driven compressor of this invention.

[0019]

As for a thin-walled part and 18, a slot and 19 are refrigerant passages the winding for which 12 winds a stator yoke and 13 around a plane of composition, 14 was wound around the insulating paper, and 15 was wound around the tooth part 16 of the stator in drawing 1, and 17.

[0020]

Drawing 2 (a) is a figure showing the stator core of the expanded state connected on the straight line before being molded in cylindrical shape. Drawing 2 (b) is a figure showing the griddle which constitutes a stator core.

[0021]

In drawing 2 (b), the tooth part 16 is radially divided at the center of the circumferencial direction, and it is developed so that a yoke part may become approximately linear shape. A part of periphery of the yoke arranged in on a straight line is connected by the thin-walled part 17. The portion which constitutes each plane of composition of the tooth parts 16a and 16b which 13a and 13b divided, the space where 18 constitutes a slot part, and the space where 19a and 19b become the refrigerant passage 19, and 20a and 20b show the guide part which served as tabling.

[0022]

Drawing 3 is a figure showing the process in which the stator core of the expanded state of drawing 2 (a) is molded circularly, it makes a fulcrum the center of the thin-walled part 17 of a stator yoke, bends it circularly, is formed annularly, and fixes the last mating face by welding etc. Bending at this time is smoothly made by the guide parts 20a and 20b which served as tabling. A thin-walled part receives tensile force from both sides by this molding, and changes with this tensile force in the direction of the space 19 for refrigerants constituted from 19a and 19b of a thick arrow, i.e., the direction.

[0023]

Drawing 4 shows the sectional view of the encapsulated type electric motor compressor which

used the stator of the brushless motor of this invention.
[0024]
In drawing 4, 1 tightens in the drum shell 6 by a stator, BAME immobilization is carried out and 2 is being fixed to the axis of rotation 4 of the compressor style 3 of a compressor by the rotator. 5 is seven, a bearing and 8 are up-and-down shell, and, as for 9, a discharge tube and 11 are the terminals for power supplies AKYUMU and 10.
[0025]
Drawing 5 (a) is a cross-sectional view simplifying and showing the state of the stator 1 of this invention included in the drum shell, and drawing 5 (b) is a cross-sectional view simplifying and showing the state of the stator 23 included in the drum shell of the encapsulated type electrically-driven compressor in drawing 8 shown by the conventional example. With the power (figure Nakaya seal) committed by tightness BAME to the drum shell of the pressure vessel which is the method to the compressor of a general stator to incorporate by having had this composition. In the case where it is divided in the yoke which connects between the tooth parts of the stator of the conventional example of drawing 5 (b). As opposed to what the moment force f1 or f2 works, and the center position of a tooth part shifts, and is easy to cause modification to an inside diameter by the imbalance of power since the plane of composition Xa and Xb are short, In the encapsulated type electrically-driven compressor of this invention of drawing 5 (a), since the plane of composition is large even if power is added to the planes of composition 13a and 13b of a tooth part, even if there is a little imbalance, the distorted difference in the whole tooth part becomes small, and does not commit moment force, either. The power F committed between the tooth parts by the motor torque generated at the time of operation is received, In the case where it is divided in the yoke which connects between the tooth parts of the stator of the conventional example of drawing 5 (b). To what the center position of a tooth part shifts and is easy to cause modification to an inside diameter since it is added to a tooth part as moment force by making the plane of composition of a yoke into a fulcrum, in the encapsulated type electrically-driven compressor of this invention of drawing 5 (a). Modification is pressed down in order that the internal stress sigma by the power in which it is added to a plane of composition (bold arrow in a figure) may improve apparent rigidity.
[0026]
Rigidity without the case of the integral-type stator core which is shown in drawing 7 as for the above result, and inferiority is obtained. the lineblock diagram 9 of a conventional example (a), (b), and (c) -- as typically shown in drawing 6 (b) in any case, many planes of composition (working example nine places) in the flow of main magnetic flux, [ exist and ] And since tabling structure and a light-gage connecting part are constituted near the plane of composition, Since a plane of composition is large and a thin-walled part and an engagement part can consist of portions which do not have on main magnetic flux to being the cause which causes increase of a leak loss of magnetic flux as this example shows to drawing 6 (a), the leak loss of magnetic flux is dramatically small. Therefore, performance equivalent to the case of the integral-type stator core shown in drawing 7 is securable. In drawing 6 (a) and (b), an arrow (a solid line and a dashed line) shows the flow of the 2-way of main magnetic flux.
[0027]
[Effect of the Invention]
It is a stator which constitutes the brushless motor used for an encapsulated type electrically-driven compressor as mentioned above according to the encapsulated type electrically-driven compressor of this invention, The tooth part of this stator yoke that consists of a griddle by which the stator which is a concentrated winding was laminated, After forming what divided radially at the center of the circumferencial direction beforehand, and carried out predetermined number connection of the periphery on the extension with thin meat in the shape developed on the straight line, The yield at the time of die cutting of a yoke goes up by bending and forming in a circle configuration by making this thin-walled part into a fulcrum, and it becomes difficult to produce distortion by making the power committed by tightness BAME to the drum shell of the pressure vessel which is the method to the compressor of a general stator to incorporate received in the large plane of composition of this stator. Vibration by a torque variation is suppressed by the rigid rise of the appearance by the internal stress generated in the plane of composition of this tooth part, and the encapsulated type electrically-driven compressor of about the same low noise as an integral type is realizable, being with an assembled die.

[0028]
By having provided the space as a passage of a refrigerant between the planes of composition of the tooth part at the time of being formed in the thin-walled part and circle configuration which were connected, and having provided the guide part which served as tabling in this space, By losing the influence on this stator yoke by modification of a thin-walled part when it bends circularly, and constituting the guide part which served as tabling to this space, bending to a round shape becomes smooth, can strengthen engagement power, and. Since an engagement part is in a place with little influence with the flow of main magnetic flux with few [ and ] planes of composition, the leakage of magnetic flux decreases dramatically, and though it is an assembled die, the encapsulated type electrically-driven compressor of the low noise in which performance does not have inferiority, either is realizable by low-loss [ of the conventional integral-type average ].

[Brief Description of the Drawings]

[Drawing 1]The figure showing the stator of the encapsulated type electrically-driven compressor in the 1 embodiment of this invention

[Drawing 2](a) The stator core perspective view before shaping in the 1 embodiment of this invention

(b) The top view of the griddle which constitutes the stator core before shaping

[Drawing 3]The figure explaining how to mold the stator core in the 1 embodiment of this invention

[Drawing 4]The sectional view of the encapsulated type electrically-driven compressor in the 1 embodiment of this invention

[Drawing 5](a) The figure explaining the power of stator tightness BAME in the 1 embodiment of this invention

(b) The figure explaining the power of stator tightness BAME of the conventional encapsulated type electrically-driven compressor

[Drawing 6](a) The figure showing the flow of the thing magnetic flux in the 1 embodiment of this invention

(b) The figure showing the flow of the magnetic flux in the conventional encapsulated type electrically-driven compressor stator yoke

[Drawing 7]The figure showing the stator of the brushless motor which consists of the conventional integral-type stator yoke

[Drawing 8]The figure showing the stator of the brushless motor which consists of the conventional assembled-die stator yoke

[Drawing 9](a) The 1st conventional encapsulated type electrically-driven compressor stator core griddle top view

(b) The 2nd conventional encapsulated type electrically-driven compressor stator core griddle top view

(c) The 3rd conventional encapsulated type electrically-driven compressor stator core griddle top view

[Description of Notations]

1, 21, and 23 Stator
2 Rotator
3 Compressor style
4 Axis of rotation
5 Bearing
6 Drum shell
7 and 8 Up-and-down shell
9 AKYUMU
10 Discharge tube
11 Power supply terminal
12, 22 stator yokes
24 Stator pieces
13a and 13b Plane of composition
26a and 26b Plane of composition
27a and 27b Plane of composition
28a and 28b Plane of composition

14 Insulating paper
15 Winding
16, 16a, and 16b Tooth part
25 Tooth part
17 Thin-walled part
18 Slot
19, 19a, and 19b Space for refrigerant passages
20a, 20b guide part
29a and 29b Engage part
30a, 30b hooking portion

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[Translation done.]

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(71)出願人　000005821
松下電器産業株式会社
大阪府門真市大字門真１００６番地
(74)代理人　100097445
弁理士　岩橋　文雄
(74)代理人　100103355
弁理士　坂口　智康
(74)代理人　100109667
弁理士　内藤　浩樹
(72)発明者　舟見　準
大阪府門真市大字門真１００６番地　松下電器産業株式会社内

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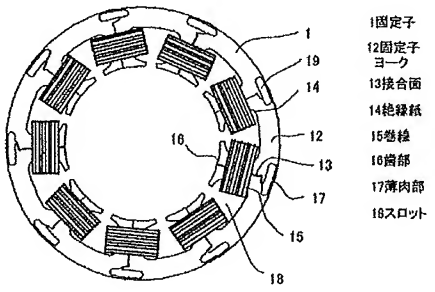
最終頁に続く

(54)【発明の名称】密閉型電動圧縮機

(57)【要約】
【課題】密閉型電動圧縮機用ブラシレスモータの分割構成される固定子の剛性を高めて振動を抑え一体型並の低騒音化を図る。
【解決手段】固定子１を歯部１６の円周方向の中心で半径方向に分割してその延長状の外周を薄肉部１７として所定数連結したものを円形状に曲げて形成し、外部からの締め付け力を歯部全体で受けるようにして変形を防ぎながら、内部応力により見かけの剛性を上げた。
【選択図】　図１



【特許請求の範囲】
【請求項１】
圧縮機構とこれを駆動するブラシレスモータとを密閉容器内に収納し、前記ブラシレスモータの固定子は、略環状の固定子ヨークと前記固定子ヨークの内周から中心に向かって延設された複数の歯部とからなる固定子鉄心と、前記歯部に電気絶縁体を介して巻装された巻き線とからなる密閉型電動圧縮機であって、前記複数の歯部はそれぞれが径方向に分割されてなり、少なくとも１つの歯部を除いて、前記分割は固定子ヨークの外周で薄肉部が残る様になされ、隣り合う歯部が前記薄肉部により互いに連結されてなることを特徴とする密閉型電動圧縮機。
【請求項２】
請求項１記載の密閉型電動圧縮機であって、固定子鉄心は鉄板を積層して形成され、前記鉄板は一部が固定子ヨークの薄肉部を有し、他は薄肉部に該当する部分が切り離されてなることを特徴とする密閉型電動圧縮機。
【請求項３】
請求項１乃至２記載の密閉型電動圧縮機であって、固定子ヨーク薄肉部と歯部分割接合面との間に空間を設けたことを特徴とする密閉型電動圧縮機。
【請求項４】
請求項３記載の密閉型電動圧縮機であって、固定子ヨーク薄肉部と歯部分割接合面との間に設けた空間が、歯部の周方向中心位置に配置されてなることを特徴とする密閉型圧縮機。
【請求項５】
請求項３記載の密閉型電動圧縮機であって、固定子ヨーク薄肉部と歯部分割接合面との間に設けた空間に噛合わせを兼ねたガイド部を設けてなることを特徴とする密閉型圧縮機。
【請求項６】
請求項３乃至４記載の密閉型電動圧縮機であって、固定子ヨーク薄肉部と歯部分割接合面との間に設けた空間を冷媒通路として用いたことを特徴とする密閉型電動圧縮機。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】
本発明は空気調和機および冷凍機器などに用いられる密閉型電動圧縮機に関するものである。
【０００２】
【従来の技術】
従来の密閉型電動圧縮機に用いられる集中巻ブラシレスモータの固定子は、図７のような固定子ヨークが一体型の積層鉄板からなるのが主流である。近年、巻線効率向上と金型コストの低減を目的として、図８のような固定子の歯部と歯部をつなぐヨークの中心で分割した積層鉄板からなる固定子片を組み合わせてなるヨークにより構成される分割型の固定子（以降分割型と称す）が使われ始めてきた。分割型固定子の構成方法としては、図９（ａ）に示す様に各々の分割された固定子片を単独で構成した後組み合わせて溶接等で固定するか、図９（ｂ）の様に分割された固定子片の接合面に噛合わせの為のフックを設け直線状に連結後円形状に形成するか、図９（ｃ）の様に分割された固定子片の接合面の一箇所をあらかじめ薄肉で連結し直線状に形成して後、円形状に曲げて固定する方法などがとられている（例えば特許文献１参照）。
【０００３】
図７において２２は固定子２１のヨーク、１４は絶縁紙、１５は固定子ヨークの歯部１６に巻回された巻線。図８において２３は固定子で、分割された固定子片２４の接合面Ｘａ、Ｘｂにて組み合わされて構成される。２４は固定子の歯部である。固定子ヨーク２３の接合面Ｘにおける従来の形状例を図９（ａ）、（ｂ）、（ｃ）に示す。
【０００４】
図９（ａ）において、２６ａ、２６ｂが接合面で、２９ａ、２９ｂの噛合部で固定し接合

面外周各々を溶接等で固定する。図９（ｂ）において、２７ａ、２７ｂが接合面で、３０ａ、３０ｂのフック部で連結固定し最終組合わせ面を溶接等で固定する。図９（ｃ）において、分割部はあらかじめ薄肉部で直線状に連結しておき、該薄肉部を円形に曲げて接合面２８ａ、２８ｂを接合し、最後の接合面にて溶接等で固定される。

【０００５】

図７と図８に示す構成には、コアに巻線を巻回後に円形上に成型して固定子にするか、円形状態で巻線を挿入するかの大きな違いがある。

【０００６】

【特許文献１】

特開平９―１９１５８８号公報

【０００７】

【発明が解決しようとする課題】

図７に示す密閉型電動圧縮機の電動機固定子では、巻線工数と、ヨークの形成における材料の歩留まりが低く、打ち抜く金型のコストも大きいいう課題があった。

【０００８】

その解決を目的とした図８に示すいずれの密閉型圧縮機の電動機固定子においても巻線効率は上がるものの、以下の課題を有していた。

【０００９】

１つ目はいずれの構成においても固定子の歯部と歯部を繋ぐヨーク部に接合面があるため剛性が低くなり振動し易くなるため騒音が大きくなること。２つ目は一般的な固定子の圧縮機への組込み方法である圧力容器の胴シェルへの絞まりバメ固定により、固定子内周側が変形し性能に影響を与えること。３つ目は各接合面で磁束の漏れ損失が増加することである。更に図９（ａ）に示す密閉型圧縮機の場合は前記課題に加え歯部各々が単独で構成されるため組立が煩雑になる課題も有していた。

【００１０】

本発明はかかる従来の課題に鑑み、図７に示す密閉型圧縮機の電動機固定子と同じ巻線挿入タイプでありながら、固定子ヨーク歯部を周方向の中心で半径方向に分割し、各々の固定子片を外周にて薄肉で連結し直線的に展開して形成後円形に曲げて固定子となす事により、従来例図８の分割型並みの打抜き歩留まりを実現し、打抜く金型のコストも下げ、一般的な固定子の圧縮機への組込み方法である圧力容器の胴シェルへの絞まりバメにより働く力を該固定子の歯部の広い接合面で受けさせることで歪を抑え、且つ該歯部の接合面に発生する内部応力による見かけの剛性アップによってトルク変動による振動を抑えて、分割型で有りながら一体型並の低騒音の密閉型電動圧縮機を提供することを目的とする。

【００１１】

【発明の実施の形態】

請求項１に記載の密閉型電動圧縮機は、圧縮機構とこれを駆動するブラシレスモータとを密閉容器内に収納し、前記ブラシレスモータの固定子は、略環状の固定子ヨークと前記固定子ヨークの内周から中心に向かって延設された複数の歯部とからなる固定子鉄心と、前記歯部に電気絶縁体を介して巻装された巻き線とからなる密閉型電動圧縮機であって、前記複数の歯部はそれぞれが径方向に分割されてなり、少なくとも１つの歯部を除いて、前記分割は固定子ヨークの外周で薄肉部が残る様になされ、隣り合う歯部が前記薄肉部により互いに連結してなるものであり、固定子鉄心をヨーク部が略直線になるように展開した形で打ち抜くことにより、２枚分の固定子鉄心鉄板を互いの歯部を噛合わせるようにレイアウトして、材料の鉄板シートから効率良く固定子鉄心鉄板を打ちぬくことが出きるという作用を有する。また、一般的な固定子の圧縮機への組込み方法である圧力容器の胴シェルへの絞まりバメによる力を、該固定子の歯部の広い接合面で受けさせる事で歪が生じ難くなる。また歯面全体に発生する内部応力により見かけの歯部剛性がアップするという作用を有する。

【００１２】

請求項２記載の密閉型電動圧縮機は、請求項１記載の密閉型電動圧縮機であって、固定子

鉄心は鉄板を積層して形成され、前記鉄板は一部が固定子ヨークの薄肉部を有し、他は薄肉部に該当する部分が切り離されてなるものであり、ヨーク部が略直線状に打ちぬかれて積層された固定子鉄心を円筒形状に折り曲げる際に一部の鉄板に形成された薄肉部を変形させるだけで良いので、より小さな力で折り曲げることが可能となるという作用を有する。

【００１３】

請求項３記載の密閉型電動圧縮機は、請求項１乃至２記載の密閉型電動圧縮機であって、固定子ヨーク薄肉部と歯部分割接合面との間に空間を設けたものであり、薄肉部が折り曲げられて変形した時に、内側に向かって変形して押し出されてきた薄肉部を、空間を設けたことで逃がすことが出きるので、より滑らかに折り曲げ加工が可能となるという作用を有する。

【００１４】

請求項４に記載の密閉型電動圧縮機は、請求項３記載の密閉型電動圧縮機であって、固定子ヨーク薄肉部と歯部分割接合面との間に設けた空間が、歯部の周方向中心位置に配置されてなるものであり、空間が磁束密度の最も小さな所に配置されるので、特性の劣化が殆ど無いという作用を有する。

【００１５】

請求項５に記載の密閉型圧縮機は、請求項３記載の密閉型電動圧縮機であって、固定子ヨーク薄肉部と歯部分割接合面との間に設けた空間に噛合わせを兼ねたガイド部を設けてなるものであり、噛み合わされた歯部どうしの噛み合い力を強固に出来るという作用を有する。

【００１６】

請求項６に記載の密閉型圧縮機は、請求項３乃至４記載の密閉型電動圧縮機であって、固定子ヨーク薄肉部と歯部分割接合面との間に設けた空間を冷媒通路として用いたものであり、電動機を冷却する働きを持つ冷媒を温度上昇の大きな巻き線の近くで通過させることでより大きな冷却効果を得ることが出きるという作用を有する。

【００１７】

（実施の形態１）

以下本発明の実施の形態について図面を参照して説明する。

【００１８】

図１は本発明の密閉型電動圧縮機におけるブラシレスモータの、固定子を示す図である。

【００１９】

図１において１２が固定子ヨーク、１３は接合面、１４が絶縁紙、１５が固定子の歯部１６に巻回された巻線、１７は薄肉部、１８はスロット、１９が冷媒通路である。

【００２０】

図２（ａ）は円筒形状に成型される前の直線上に連結された展開状態の固定子鉄心を示す図である。図２（ｂ）は固定子鉄心を構成する鉄板を示す図である。

【００２１】

図２（ｂ）において、歯部１６はその円周方向の中心で半径方向に分割され、ヨーク部が略直線状になるように展開している。直線上に並べたヨークの外周の一部を薄肉部１７で連結してある。１３ａ、１３ｂは分割した歯部１６ａ、１６ｂの各々の接合面、１８はスロット部を構成する空間、１９ａ、１９ｂは冷媒通路１９となる空間を構成する部分、２０ａ、２０ｂは噛合わせを兼ねたガイド部を示す。

【００２２】

図３は図２（ａ）の展開状態の固定子鉄心を円形に成型する過程を示す図で、固定子ヨークの薄肉部１７の中心を支点にして円形に曲げて環状に形成し、最後の合わせ面を溶接等で固定する。この時の曲げ加工は噛合わせを兼ねたガイド部２０ａ，２０ｂによって円滑になされる。この成型によって薄肉部は両側から引張力を受け、該引張力によって太い矢印の方向、すなわち１９ａ，１９ｂで構成する冷媒用空間１９の方向へ変形する。

【００２３】

図４は本発明のブラシレスモータの固定子を用いた密閉型電動機圧縮機の断面図を示す。

【００２４】

図４において、１は固定子で胴シェル６に絞まりバメ固定され２は回転子で圧縮機の圧縮機構３の回転軸４に固定されている。５は軸受、７、８は上下シェルで、９はアキューム、１０は吐出管、１１は電源用端子である。

【００２５】

図５（ａ）は胴シェルに組み込まれた本発明の固定子１の状態を簡略化して示した横断面図で、図５（ｂ）は従来例で示した図８における密閉型電動圧縮機の胴シェルに組み込まれた固定子２３の状態を簡略化して示した横断面図である。かかる構成にしたことによって、一般的な固定子の圧縮機への組込み方法である圧力容器の胴シェルへの絞まりバメによって働く力（図中矢印）により、図５（ｂ）の従来例の固定子の歯部間を繋ぐヨークで分割された場合では、接合面Ｘａ、Ｘｂが短いため力のアンバランスによってモーメント力ｆ１又はｆ２が働き歯部の中心位置がずれて内径に変形を引き起こし易いのに対して、図５（ａ）の本発明の密閉型電動圧縮機では、歯部の接合面１３ａ、１３ｂに力が加わっても、接合面が広いので、少々のアンバランスが有っても歯部全体での歪の差は僅かとなり、モーメント力も働かない。又、運転時に発生するモータトルクによる歯部間に働く力Ｆに対しては、図５（ｂ）の従来例の固定子の歯部間を繋ぐヨークで分割された場合では、ヨークの接合面を支点として歯部にモーメント力として加わるため歯部の中心位置がずれて内径に変形を引き起こし易いのに対して、図５（ａ）の本発明の密閉型電動圧縮機では、接合面に加わる力による内部応力σ（図中太矢印）が見かけの剛性を高める為変形が押さえられる。

【００２６】

以上の結果図７に示す一体型固定子鉄心の場合と遜色のない剛性が得られる。また従来例の構成図９（ａ）、（ｂ）、（ｃ）いずれの場合も図６（ｂ）に模式的に示す様に主磁束の流れの中に多くの接合面（実施例では９箇所）が存在し、且つ噛合わせ構造や薄肉連結部を接合面近傍に構成されているため、磁束のもれ損失の増大を招く原因となっているのに対し、本実施例では図６（ａ）に示す様に接合面が広く薄肉部や噛合い部が主磁束に影響を及ぼさない部分で構成できるため磁束のもれ損失は非常に小さい。したがって、図７に示す一体型固定子鉄心の場合と同等の性能が確保できる。図６（ａ）、（ｂ）において矢印（実線と破線）が主磁束の２方向の流れを示す。

【００２７】

【発明の効果】

以上の様に本発明の密閉型電動圧縮機によれば、密閉型電動圧縮機に用いられるブラシレスモータを構成する固定子であって、集中巻である固定子の積層された鉄板からなる該固定子ヨークの歯部を、あらかじめ円周方向の中心で半径方向に分割してその延長上の外周を薄肉で所定数連結したものを直線上に展開した形状で形成した後、該薄肉部を支点として円形状に曲げて形成することによってヨークの打抜き時の歩留まりが上がり、一般的な固定子の圧縮機への組込み方法である圧力容器の胴シェルへの絞まりバメにより働く力を該固定子の広い接合面で受けさせる事で歪が生じ難くなる。また該歯部の接合面に発生する内部応力による見かけの剛性アップによってトルク変動による振動を抑えて、分割型で有りながら一体型並の低騒音の密閉型電動圧縮機を実現できる。

【００２８】

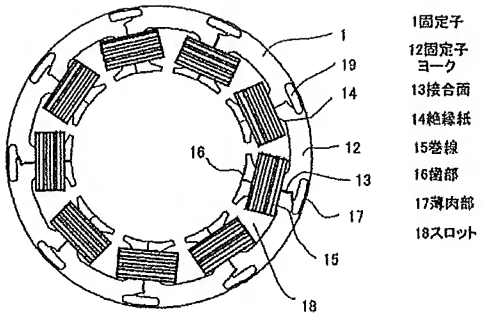
また、連結された薄肉部と円形状に形成される際の歯部の接合面との間に冷媒の通路としての空間を設け、該空間に噛合わせを兼ねたガイド部を設けたことによって、円形に曲げた時の薄肉部の変形による該固定子ヨークへの影響がなくなり、該空間に噛合わせを兼ねたガイド部を構成することによって、円形への曲げ加工が滑らかになり、且つ噛合い力を強固に出来ると共に、接合面が少なく且つ主磁束の流れへの影響の少ない所に噛合い部がある為、磁束の漏れが非常に少なくなり、分割型でありながら従来の一体型並の低損失で性能も遜色のない低騒音の密閉型電動圧縮機を実現できる。

【図面の簡単な説明】

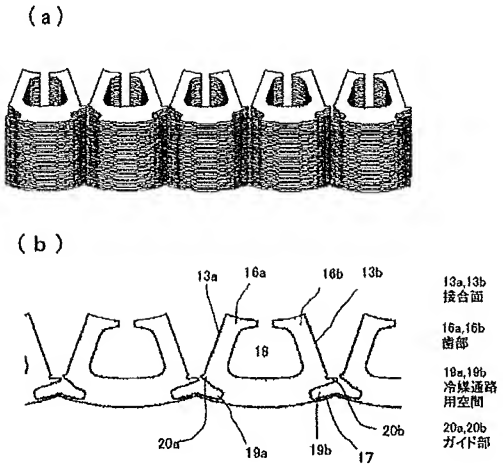
【図１】本発明の一実施の形態における密閉型電動圧縮機の固定子を示す図
【図２】（ａ）本発明の一実施の形態における成形前の固定子鉄心斜視図
（ｂ）成形前の固定子鉄心を構成する鉄板の平面図
【図３】本発明の一実施の形態における固定子鉄心を成型する方法を説明する図
【図４】本発明の一実施の形態における密閉型電動圧縮機の断面図
【図５】（ａ）本発明の一実施の形態における固定子絞まりバメの力を説明する図
（ｂ）従来の密閉型電動圧縮機の固定子絞まりバメの力を説明する図
【図６】（ａ）本発明の一実施の形態におけるの磁束の流れを示す図
（ｂ）従来の密閉型電動圧縮機固定子ヨークにおける磁束の流れを示す図
【図７】従来の一体型固定子ヨークからなるブラシレスモータの固定子を示す図
【図８】従来の分割型固定子ヨークからなるブラシレスモータの固定子を示す図
【図９】（ａ）第１の従来の密閉型電動圧縮機固定子鉄心鉄板平面図
（ｂ）第２の従来の密閉型電動圧縮機固定子鉄心鉄板平面図
（ｃ）第３の従来の密閉型電動圧縮機固定子鉄心鉄板平面図
【符号の説明】

| | |
|---|---|
| １、２１、２３ | 固定子 |
| ２ | 回転子 |
| ３ | 圧縮機構 |
| ４ | 回転軸 |
| ５ | 軸受 |
| ６ | 胴シェル |
| ７、８ | 上下シェル |
| ９ | アキューム |
| １０ | 吐出管 |
| １１ | 電源端子 |
| １２、２２ | 固定子ヨーク |
| ２４ | 固定子片 |
| １３ａ、１３ｂ | 接合面 |
| ２６ａ、２６ｂ | 接合面 |
| ２７ａ、２７ｂ | 接合面 |
| ２８ａ、２８ｂ | 接合面 |
| １４ | 絶縁紙 |
| １５ | 巻線 |
| １６、１６ａ、１６ｂ | 歯部 |
| ２５ | 歯部 |
| １７ | 薄肉部 |
| １８ | スロット |
| １９、１９ａ、１９ｂ | 冷媒通路用空間 |
| ２０ａ、２０ｂ | ガイド部 |
| ２９ａ、２９ｂ | 噛合部 |
| ３０ａ、３０ｂ | フック部 |

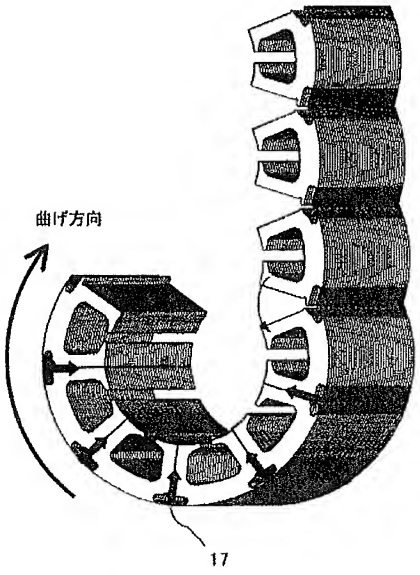
【図１】


1
19
14
12
13
17
15
18
16
1固定子
12固定子ヨーク
13接合面
14絶縁紙
15巻線
16歯部
17薄肉部
18スロット

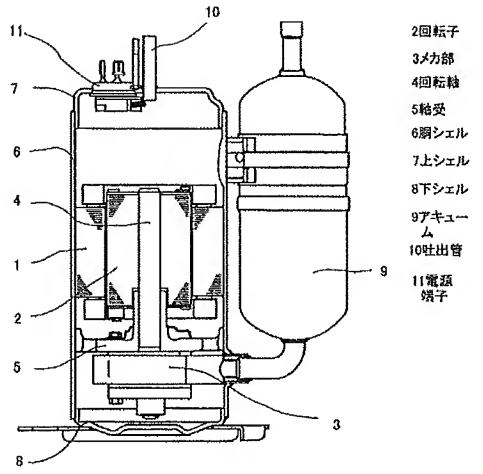
【図２】


(a)
(b)
13a
16a
16b
13b
18
20a
19a
19b
17
20b
13a,13b 接合面
16a,16b 歯部
19a,19b 冷媒通路用空間
20a,20b ガイド部

【図３】

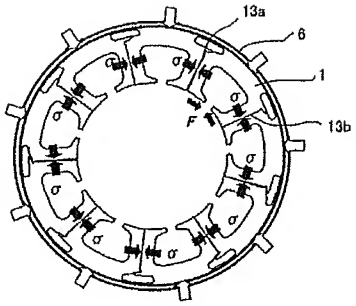

曲げ方向
17

【図４】

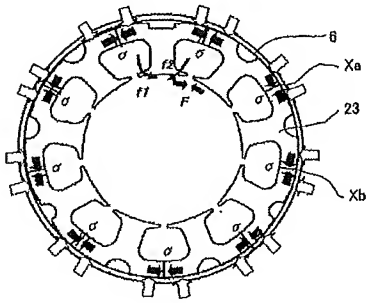

10
11
7
6
4
1
2
5
8
3
9
2回転子
3メカ部
4回転軸
5軸受
6胴シェル
7上シェル
8下シェル
9アキューム
10吐出管
11電源端子

【図５】

(a)

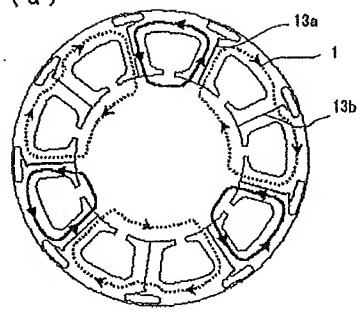



(b)

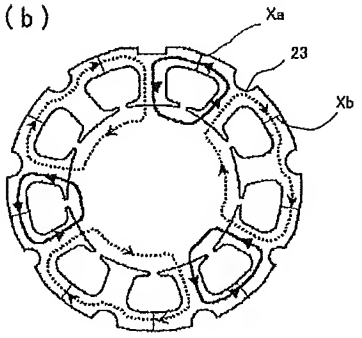



【図６】

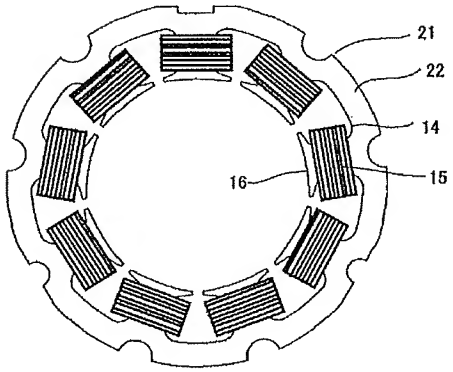
(a)



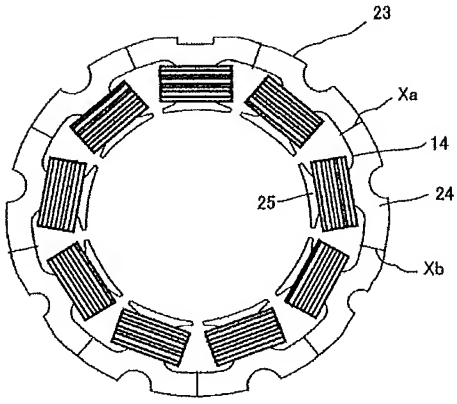

(b)



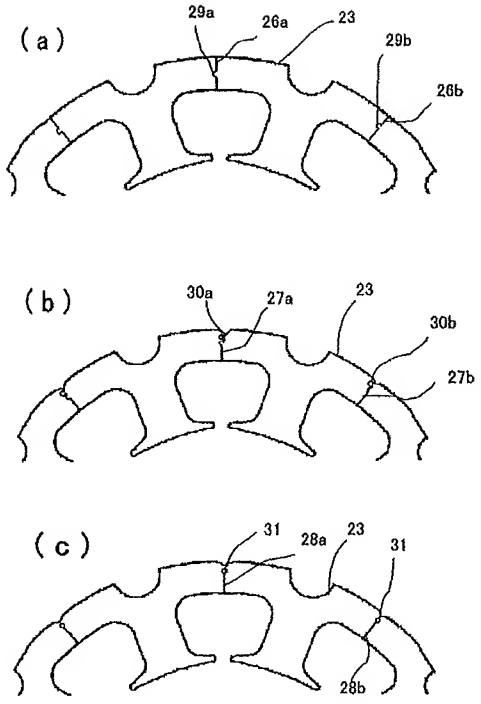

【図７】




【図８】



【図９】



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5H002 AA04 AA06 AA07 AB01 AC08 AE01 AE08